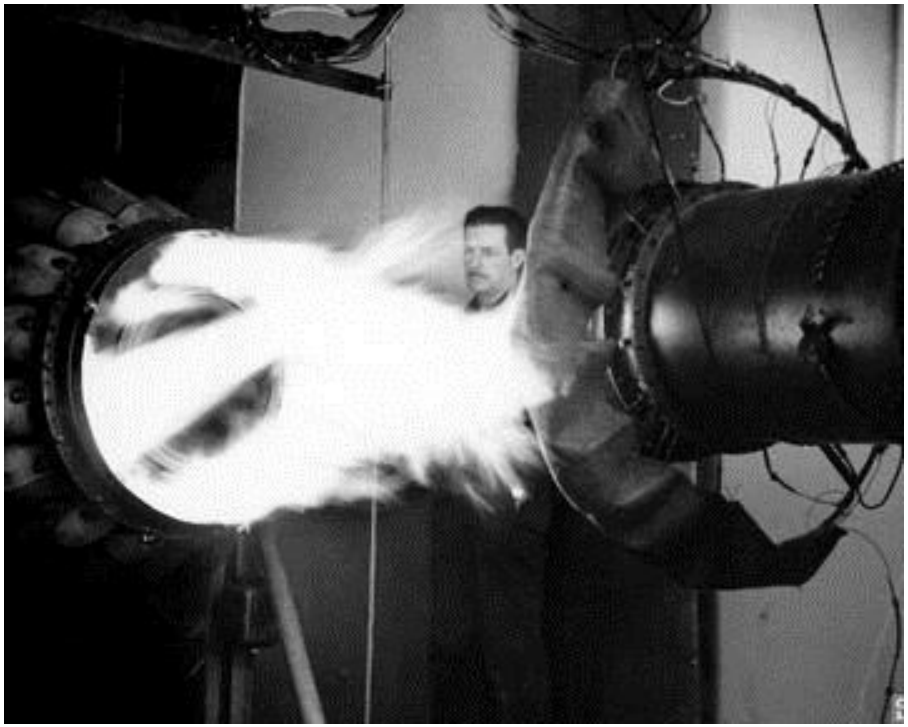
Active Combustion Control

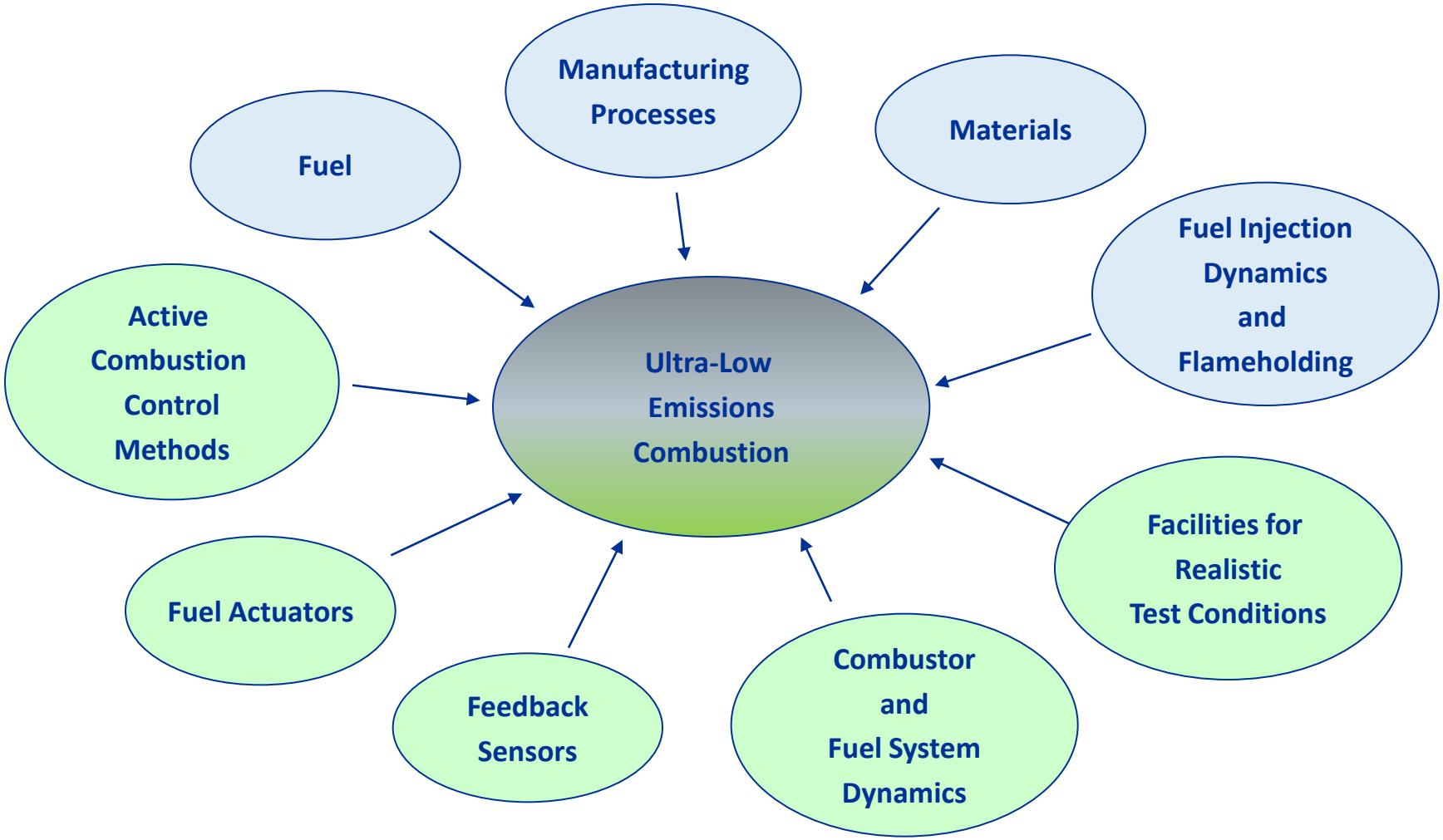
Thomas J. Stueber
Clarence T. Chang
Randy Thomas
Joseph R. Saus

Active Combustion Control

- Long distinguished history of aeronautical propulsion research
- NASA (NACA) GRC (LeRC) propulsion research
  - Increase performance,
  - Decrease emissions, and
  - Decrease noise.
- Combustion research
  - Lean burning direct injection (LDI) systems
  - Thermo-acoustic instabilities



Synergistic Technologies to Enable Ultra-Low Emissions Combustion



Active Combustion Control Team

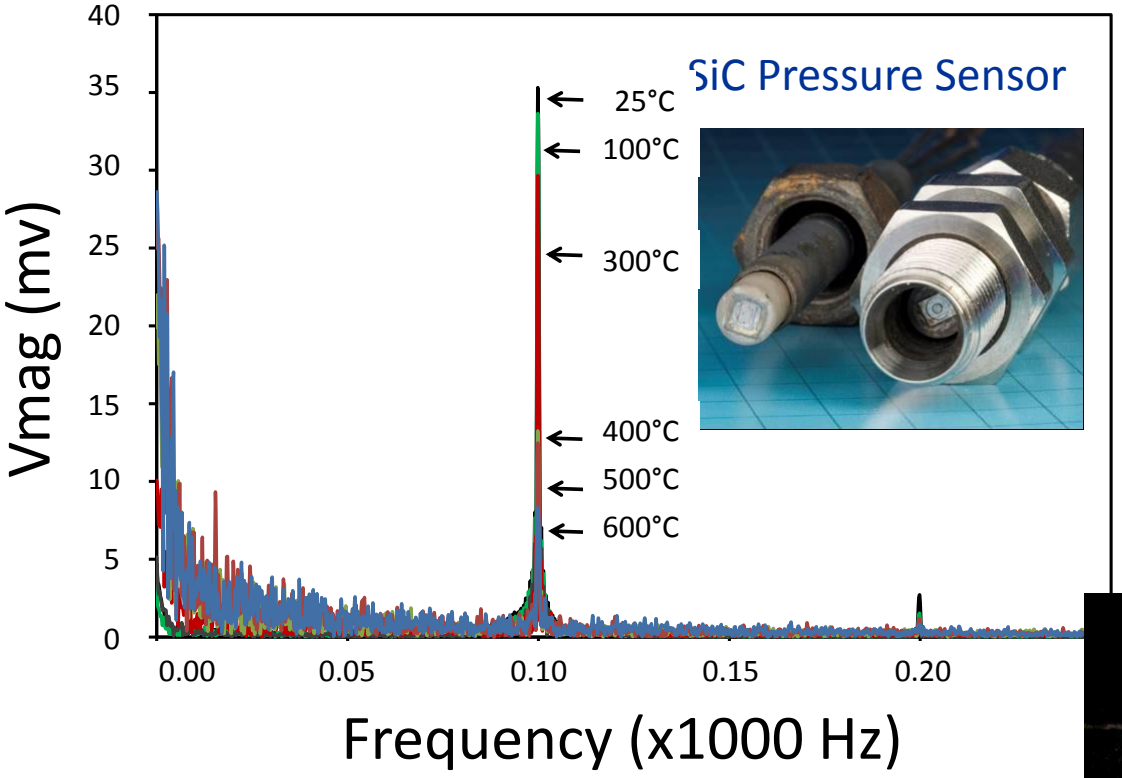
- NASA GRC Research Directorate:
  - Aeropropulsion Division
    - Combustion Branch (**RTB**)
      - **Clarence Chang**
  - Communication, Instrumentation, and Controls Division
    - Controls and Dynamics Branch (**RHC**)
      - **Thomas J. Stueber, Joseph R. Saus, Randy Thomas**
    - Sensors and Electronics Branch (**RHS**)
      - **Glenn M. Beheim, Gary W. Hunter, Robert S. Okojie**
- NASA GRC Engineering Directorate:
  - Systems Engineering and Analysis Division
    - Propulsion & Control Systems Engineering (**DSS**)
      - **Daniel R. Vrnak**
- Industry Partners:
  - Active Signal Technologies, Inc.,
  - Jansen's Aircraft Systems Controls, Inc.,
  - Wask Engineering, Inc.

In-house Activities

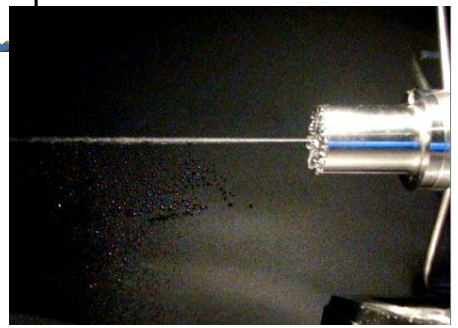
- High temperature dynamic pressure sensors
- Atomizer fuel injectors
- Hardware in the Loop (HIL) project

ACC Technology

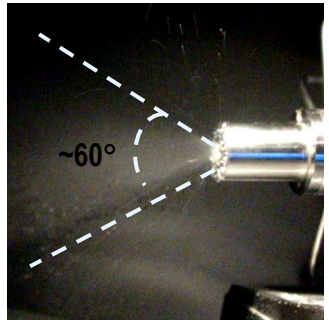
High temperature dynamic pressure sensors



Atomizer fuel injectors



Injection with no air



Spray atomization with air on

HIL Project

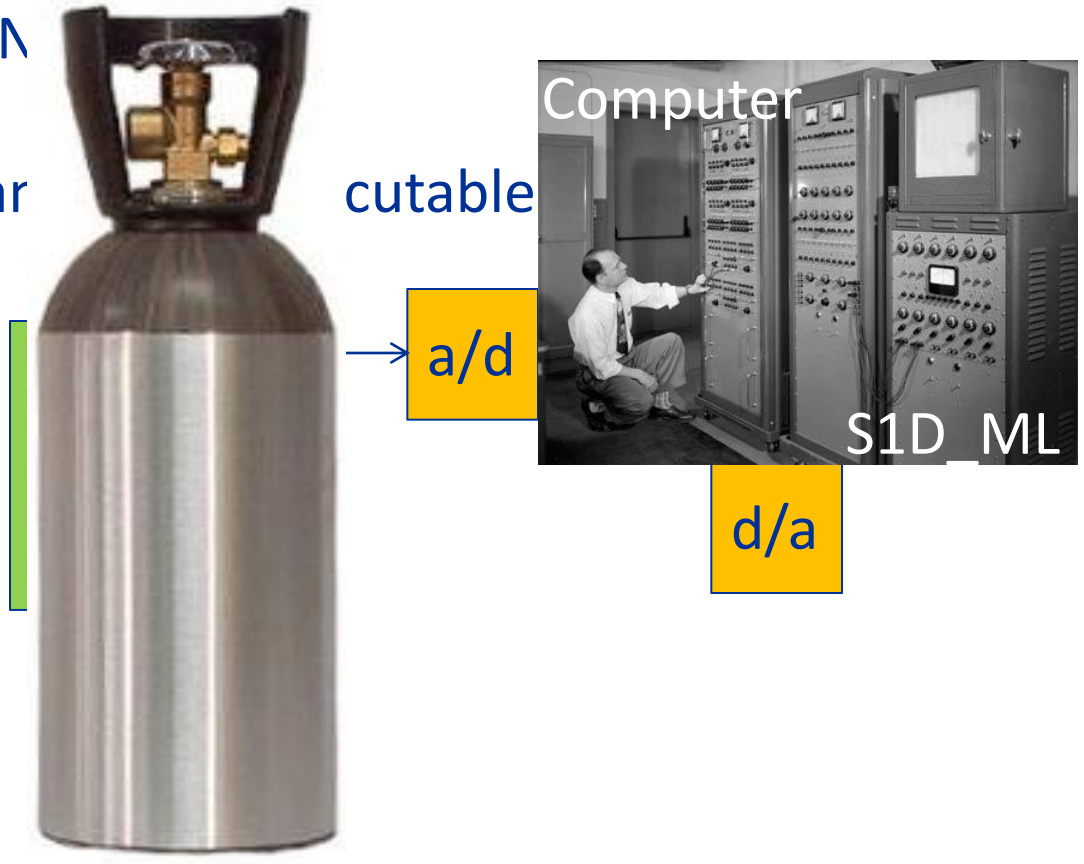
One-Di L)

- Very s oustor Simul
- MatLa
- Comp

HIL Project

One-Dimensional Combustor Simulation (S1D_ML)

- Very similar to NASA Sectored-One-Dimensional Combustor Simulation (FORTRAN
- MatLab text format
- Compiled to be a star cutable



HIL Project

One-Dimensional Combustor Simulation (S1D_ML)

- Very similar to NASA Sectored-One-Dimensional Combustor Simulation (FORTRAN code)
- MatLab text format
- Compiled to be a stand-alone executable

CE7 Fuel Injector

a/d

d/a

HIL Project

One-Dimensional Co mulation (S1D_ML)

- Very similar to NASA e-Dimensional Combustor Simulation (FORTRAN
- MatLab text format
- Compiled to be a star cutable

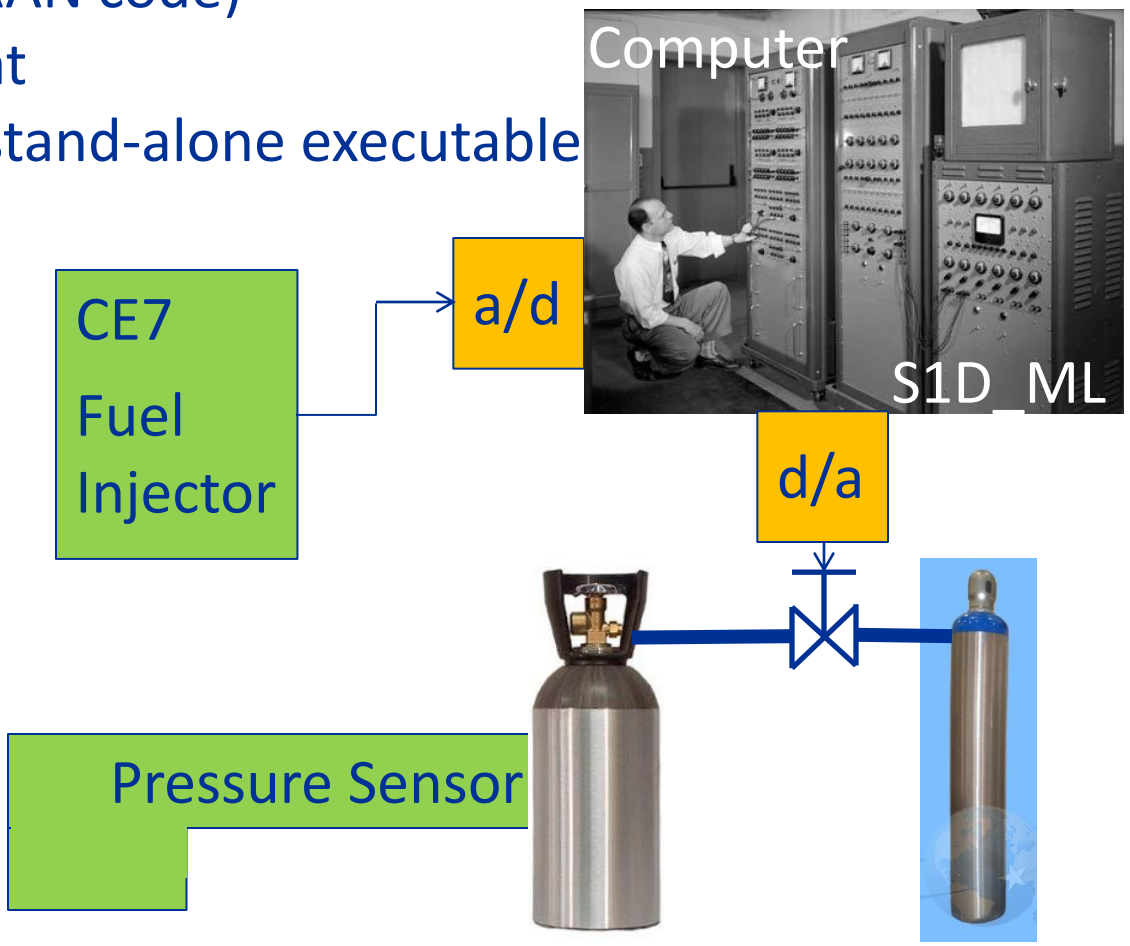
a/d

d/a

HIL Project

One-Dimensional Combustor Simulation (S1D_ML)

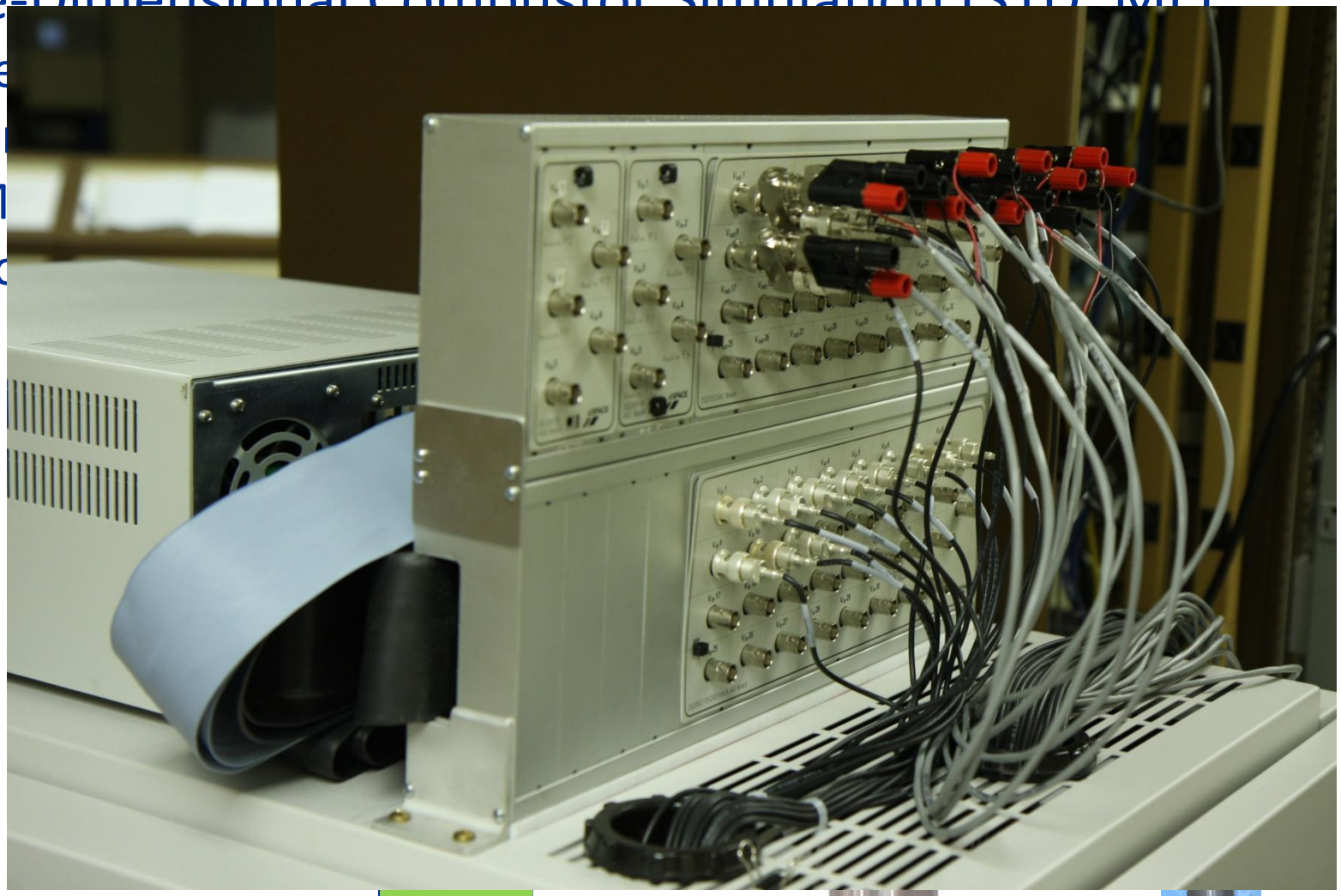
- Very similar to NASA Sectored-One-Dimensional Combustor Simulation (FORTRAN code)
- MatLab text format
- Compiled to be a stand-alone executable



HIL Project

One-Dimensional Combustor Simulation (S1D_ML)

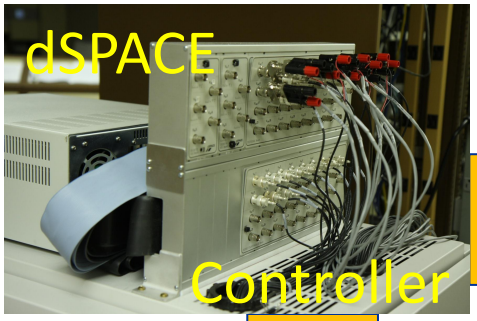
- Ve
  Si
- M
- Co

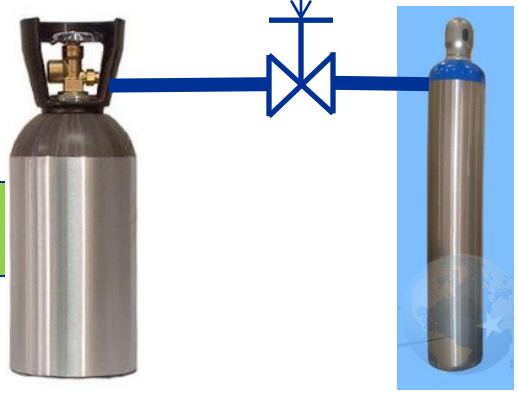


HIL Project

One-Dimensional Combustor Simulation (S1D_ML)

- Very similar to NASA Sectored-One-Dimensional Combustor Simulation (FORTRAN code)
- MatLab text format
- Compiled to be a stand-alone executable





d/a

CE7 Fuel Injector

a/d

d/a

a/d

Pressure Sensor